

Automated Mirror Cover Naval Precision Optical Interferometer

Team 8
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Rogelio Blanco
Miles Dehlin
Leland Doyle
Salazar Grey
Katherine Hewey
Paul Owen



Aerial view of the NPOI facility

Overview

- Problem Statement
- Analysis
- Concept Modification
- Client Suggestions
- Conclusion
- Updated Gantt Chart

Problem Statement

- Automatic mirror cover is needed at NPOI and must operate without interfering with current equipment while maintaining a nitrogen purge.

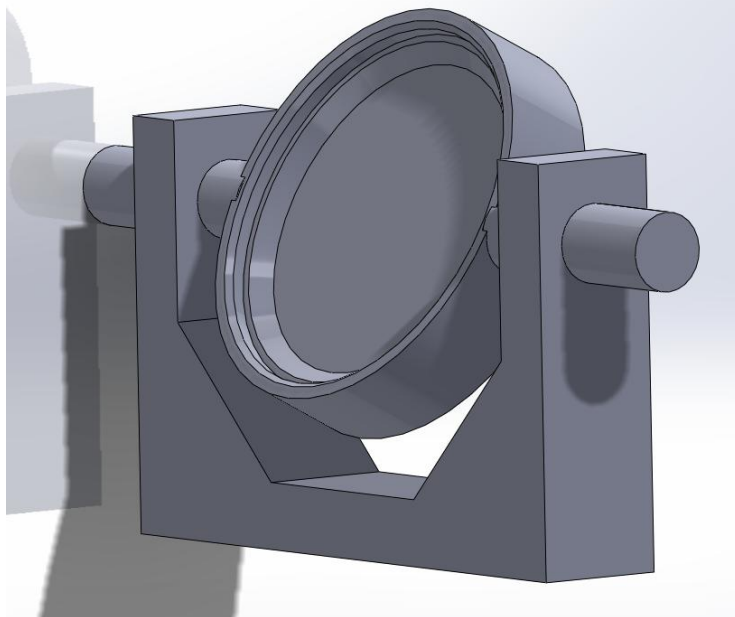
Additional Design Considerations

- Several concerns were expressed after presenting our selected concepts to our sponsor
- Material issues
- Environmental issues
 - Wind
- Clearance issues,
 - Particularly on some of the older siderostat designs

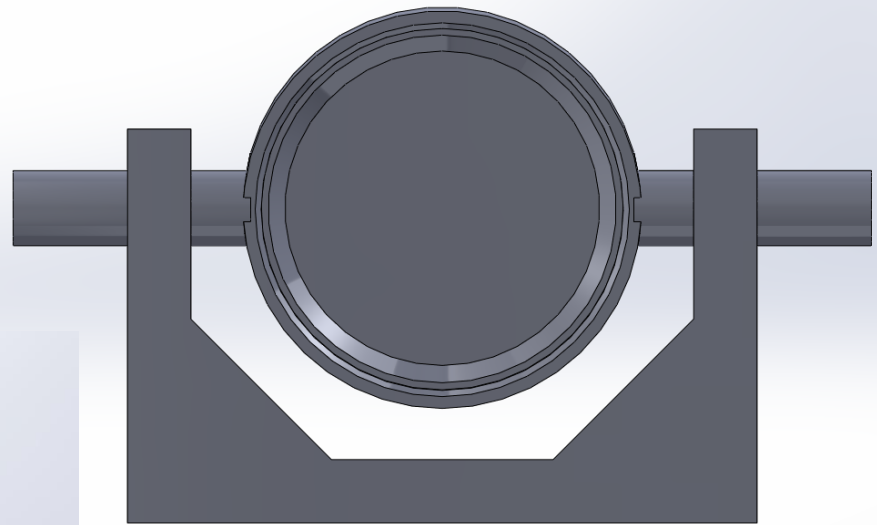
Siderostat Clearance

- Kinematic Position Analysis will allow four bar concept to be evaluated
 - 4 inches below mirror
 - $\frac{1}{2}$ inch when tilted
 - 10 inches above mirror

Siderostat Model

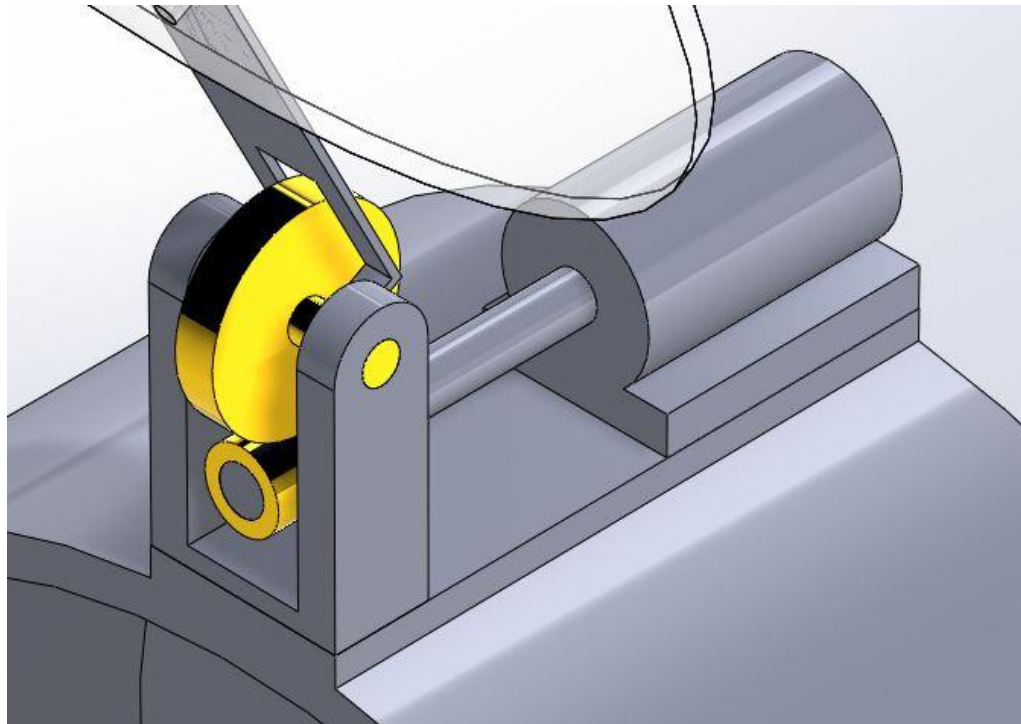


Isometric View of Siderostat

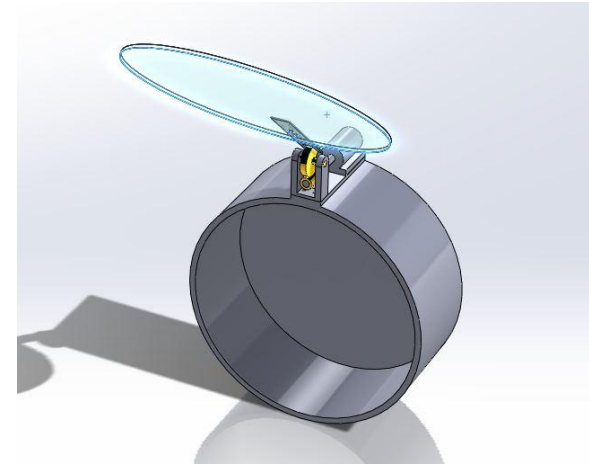


Front View of Siderostat

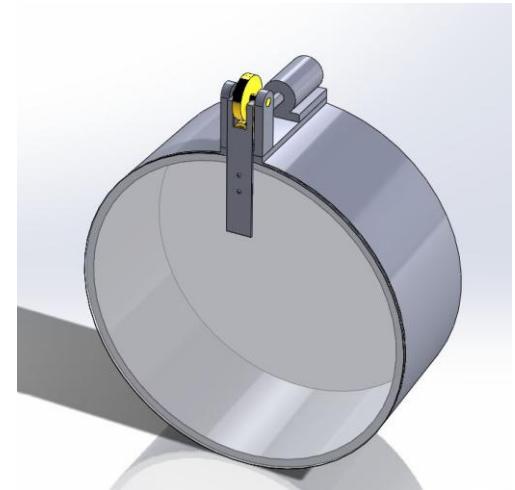
Worm Gear Design



Mechanism Close up



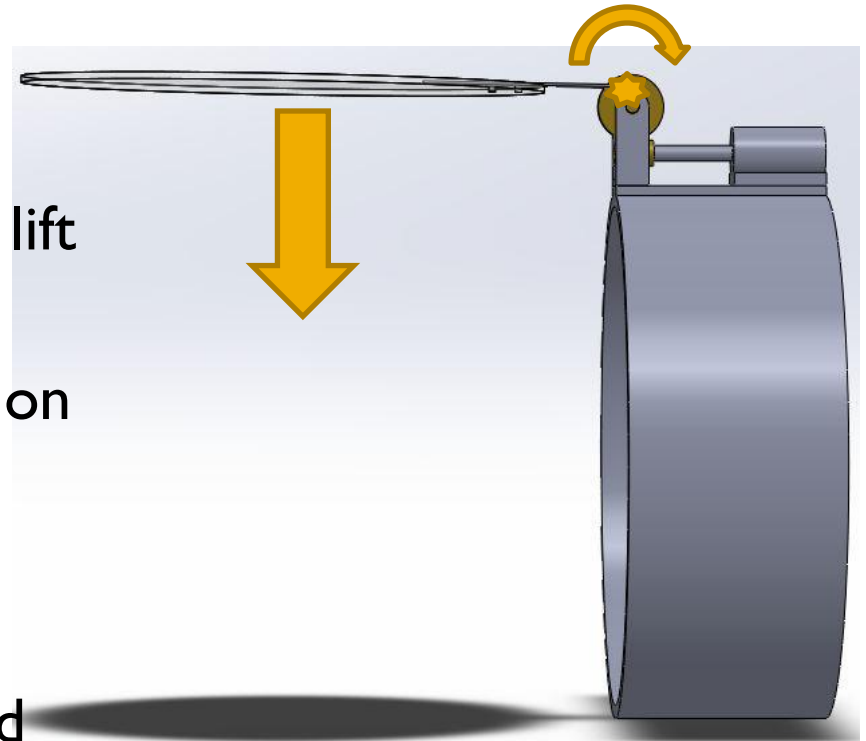
Cover Open



Cover Closed

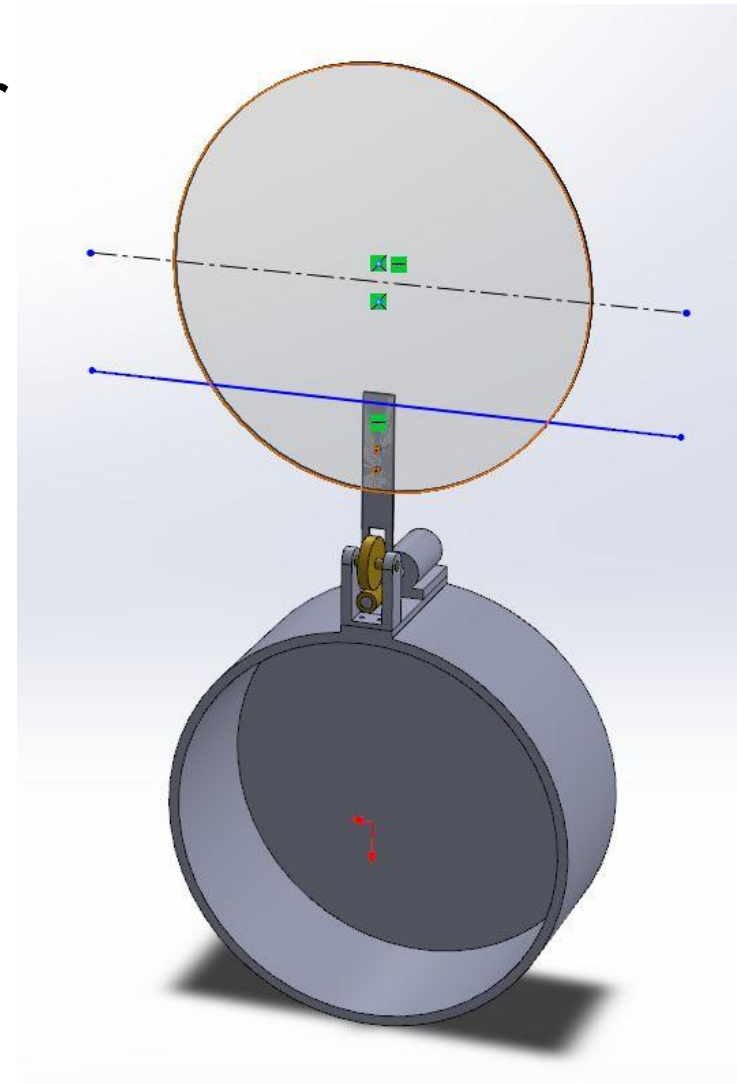
Worm and Gear

- Calculations
 - Max force due to gravity
 - Required torque to lift the cover.
 - Max bending stress on the armature.
 - Required gear ratio for slow controlled motion and required torque.



Worm and Gear

- Clearance is a larger issue than first anticipated.
- 10 inched of clearance given
- Clearance requirement
 - 20 inches 2 piece
 - 33 inches 1 piece



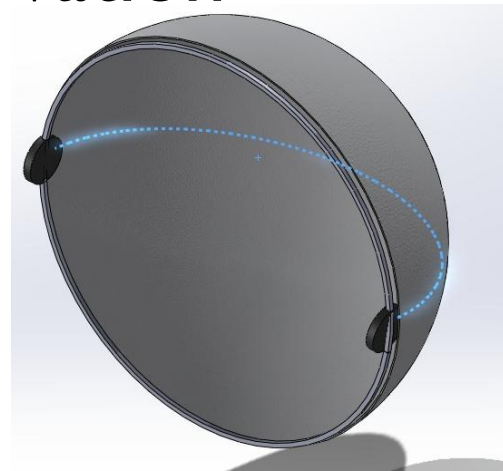
Worm and Gear

- Grease will collect on the surface of the mirror over time.
- Specialized lubricants to prevent grease evaporation exceed our budget.

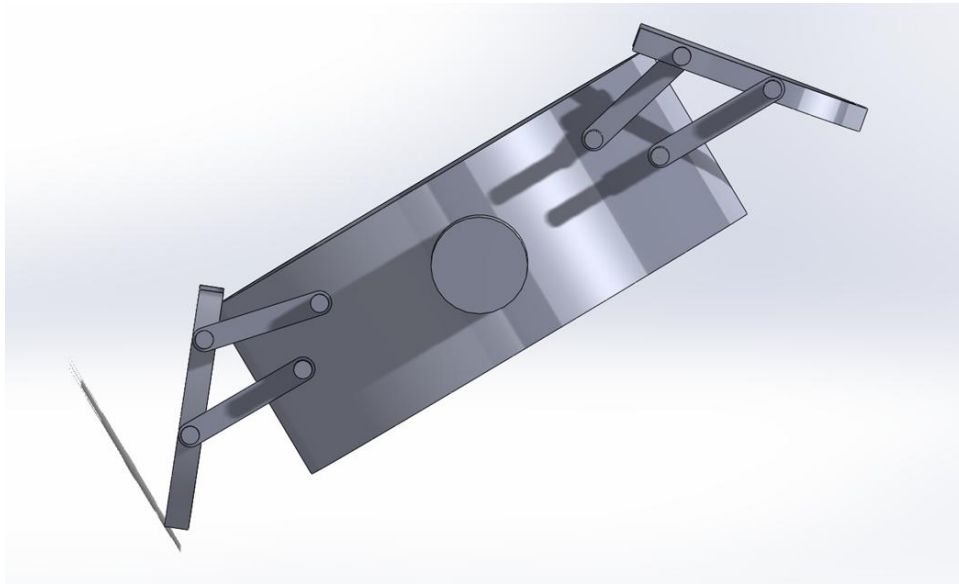


Inflatable Baby Carriage

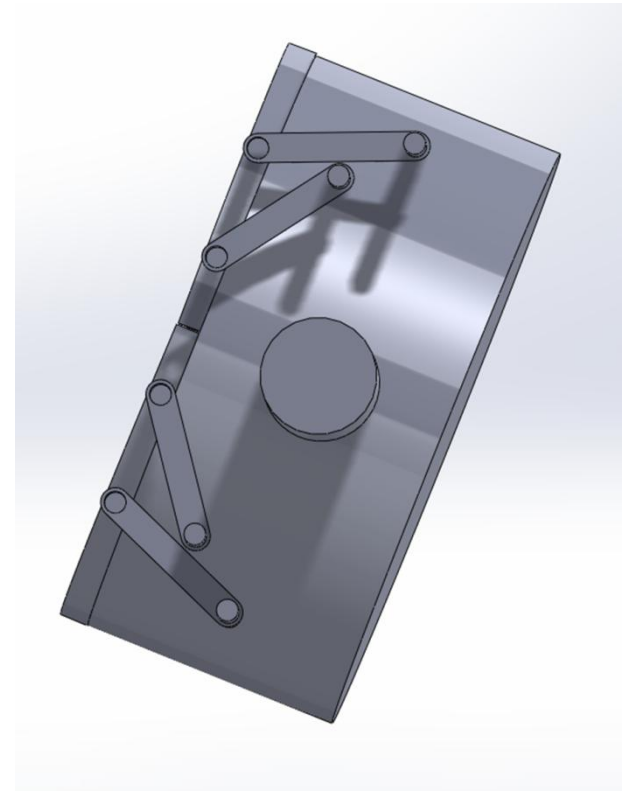
- Retracted there would have been folds in the fabric.
- Wind could turn the fabric folds into “sails”
- This would jeopardize the Siderostat stability during observation



Four Link Design



Cover Open



Cover Closed



Four Link Clearance

Client Suggestions

- Blinds

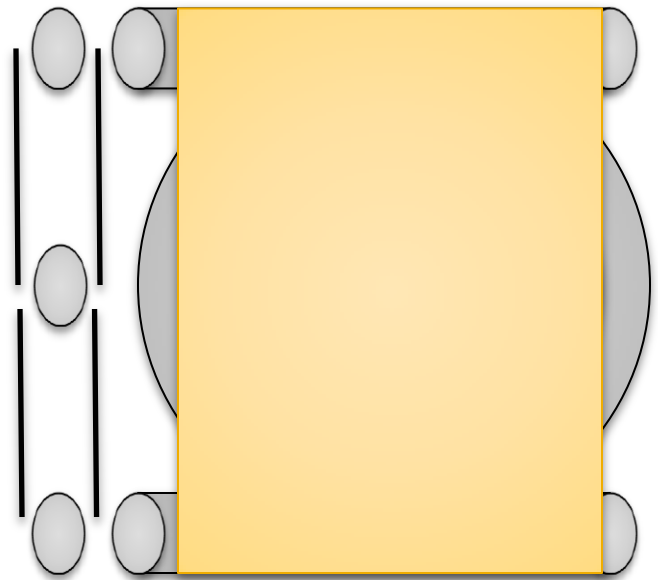
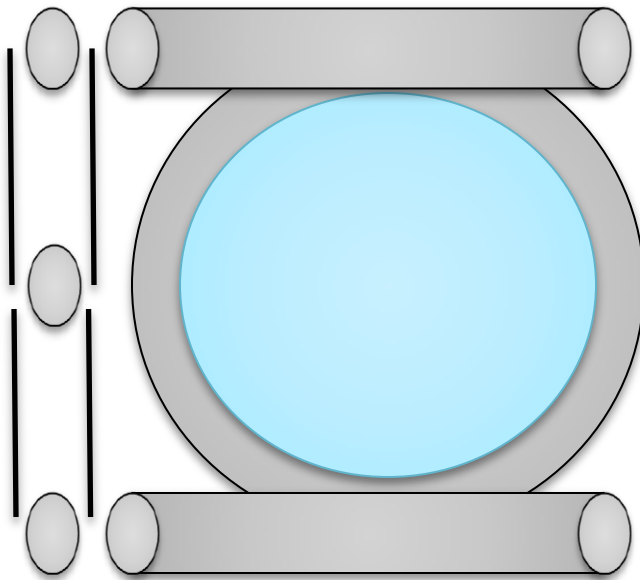


Figure 1 – Blinds open

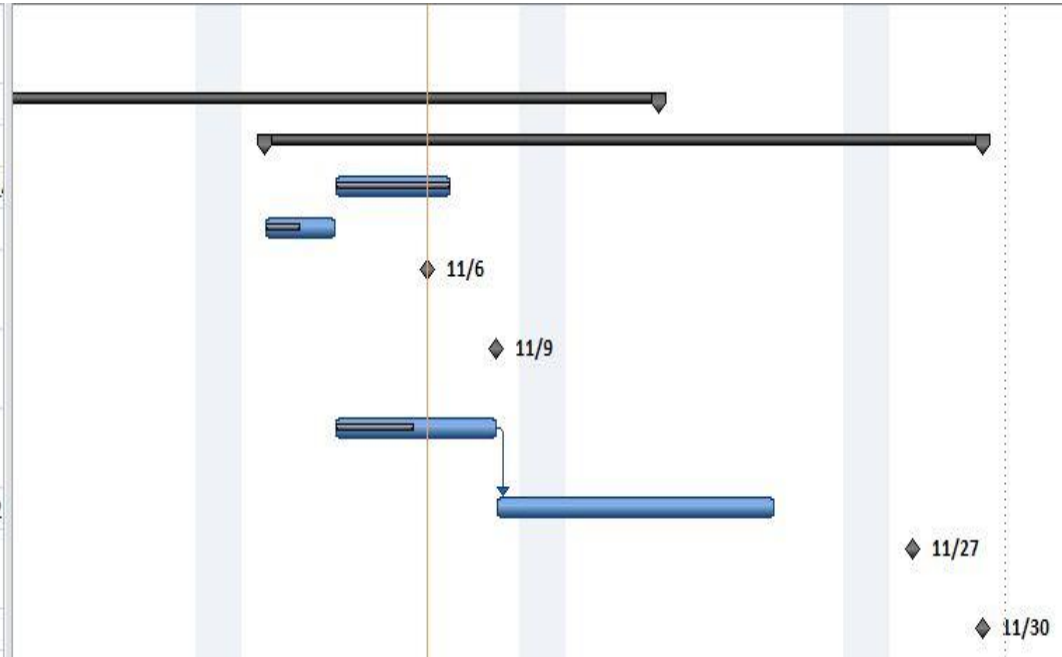
Figure 2 – Blinds closed

Design Details

- **Drilling for Nitrogen Purge vs. adding to siderostat cover**
- **Mounts**
 - Drill into siderostat
 - Strap mount
- **Motor Location**
 - One motor with belt vs. two motors
 - One motor with spring loaded roller

Gantt chart

± Project Assesment and Identification	8 days?	Thu 9/27/12	Tue 10/9/12
± Design and Testing	24 days	Sat 10/13/12	Thu 11/15/12
▢ Prototype Analysis	23 days	Tue 10/30/12	Fri 11/30/12
Solid Works model	3 days	Fri 11/2/12	Tue 11/6/12
Materials Selection	3 days	Tue 10/30/12	Thu 11/1/12
Presentation: Engineering Analysis	0 days	Tue 11/6/12	Tue 11/6/12
Report: Engineering Analysis	0 days	Fri 11/9/12	Fri 11/9/12
Redesign of Analyzed components	5 days	Fri 11/2/12	Thu 11/8/12
Concept Finalization	8 days	Fri 11/9/12	Tue 11/20/12
Presentation: Final Design	0 days	Tue 11/27/12	Tue 11/27/12
Report: Final Design	0 days	Fri 11/30/12	Fri 11/30/12



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- Questions?